RAD
data communications

Installation and Operation Manual

SPS-6, SPS-12

Multiprotocol FRAD/PAD Packet Switches

SPS-6, SPS-12

Multiprotocol FRAD/PAD Packet Switches
Installation and Operation Manual

Notice

This manual contains information that is proprietary to RAD Data Communications Ltd. ("RAD"). No part of this publication may be reproduced in any form whatsoever without prior written approval by RAD Data Communications.

Right, title and interest, all information, copyrights, patents, know-how, trade secrets and other intellectual property or other proprietary rights relating to this manual and to the SPS-6, SPS-12 and any software components contained therein are proprietary products of RAD protected under international copyright law and shall be and remain solely with RAD.

SPS-6, SPS-12 is a registered trademark of RAD. No right, license, or interest to such trademark is granted hereunder, and you agree that no such right, license, or interest shall be asserted by you with respect to such trademark.

You shall not copy, reverse compile or reverse assemble all or any portion of the Manual or the SPS-6, SPS-12. You are prohibited from, and shall not, directly or indirectly, develop, market, distribute, license, or sell any product that supports substantially similar functionality as the SPS-6, SPS-12, based on or derived in any way from the SPS-6, SPS-12. Your undertaking in this paragraph shall survive the termination of this Agreement.

This Agreement is effective upon your opening of the SPS-6, SPS-12 package and shall continue until terminated. RAD may terminate this Agreement upon the breach by you of any term hereof. Upon such termination by RAD, you agree to return to RAD the SPS-6, SPS-12 and all copies and portions thereof.

For further information contact RAD at the address below or contact your local distributor.

International Headquarters
RAD Data Communications Ltd.

24 Raoul Wallenberg St.
Tel Aviv 69719 Israel
Tel: 972-3-6458181
Fax: 972-3-6498250
E-mail: market@rad.com

North America Headquarters
RAD Data Communications Inc.

900 Corporate Drive
Mahwah, NJ 07430 USA
Tel: (201) 529-1100, Toll free: 1-800-444-7234
Fax: (201) 529-5777
E-mail: market@radusa.com

© 1993–2006 RAD Data Communications Ltd. Publication No. 216-201-10/06

Limited Warranty

RAD warrants to DISTRIBUTOR that the hardware in the SPS-6, SPS-12 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

If, during the warranty period, any component part of the equipment becomes defective by reason of material or workmanship, and DISTRIBUTOR immediately notifies RAD of such defect, RAD shall have the option to choose the appropriate corrective action: a) supply a replacement part, or b) request return of equipment to its plant for repair, or c) perform necessary repair at the equipment's location. In the event that RAD requests the return of equipment, each party shall pay one-way shipping costs.

RAD shall be released from all obligations under its warranty in the event that the equipment has been subjected to misuse, neglect, accident or improper installation, or if repairs or modifications were made by persons other than RAD's own authorized service personnel, unless such repairs by others were made with the written consent of RAD.

The above warranty is in lieu of all other warranties, expressed or implied. There are no warranties which extend beyond the face hereof, including, but not limited to, warranties of merchantability and fitness for a particular purpose, and in no event shall RAD be liable for consequential damages.

RAD shall not be liable to any person for any special or indirect damages, including, but not limited to, lost profits from any cause whatsoever arising from or in any way connected with the manufacture, sale, handling, repair, maintenance or use of the SPS-6, SPS-12, and in no event shall RAD's liability exceed the purchase price of the SPS-6, SPS-12.

DISTRIBUTOR shall be responsible to its customers for any and all warranties which it makes relating to SPS-6, SPS-12 and for ensuring that replacements and other adjustments required in connection with the said warranties are satisfactory.

Software components in the SPS-6, SPS-12 are provided "as is" and without warranty of any kind. RAD disclaims all warranties including the implied warranties of merchantability and fitness for a particular purpose. RAD shall not be liable for any loss of use, interruption of business or indirect, special, incidental or consequential damages of any kind. In spite of the above RAD shall do its best to provide error-free software products and shall offer free Software updates during the warranty period under this Agreement.

RAD's cumulative liability to you or any other party for any loss or damages resulting from any claims, demands, or actions arising out of or relating to this Agreement and the SPS-6, SPS-12 shall not exceed the sum paid to RAD for the purchase of the SPS-6, SPS-12. In no event shall RAD be liable for any indirect, incidental, consequential, special, or exemplary damages or lost profits, even if RAD has been advised of the possibility of such damages.

This Agreement shall be construed and governed in accordance with the laws of the State of Israel.

Product Disposal

To facilitate the reuse, recycling and other forms of recovery of waste equipment in protecting the environment, the owner of this RAD product is required to refrain from disposing of this product as unsorted municipal waste at the end of its life cycle. Upon termination of the unit's use, customers should provide for its collection for reuse, recycling or other form of environmentally conscientious disposal.

General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

Safety Symbols

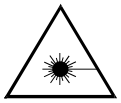
Warning

This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.

Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.

.

Protective earth: the marked lug or terminal should be connected to the building protective earth bus.



Warning

Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached. Please observe the following precautions:

- **Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.**
- **Do not attempt to adjust the laser drive current.**
- **Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.**
- **The use of optical devices with the equipment will increase eye hazard.**
- **Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.**

ATTENTION: The laser beam may be invisible!

In some cases, the users may insert their own SFP laser transceivers into the product. Users are alerted that RAD cannot be held responsible for any damage that may result if non-compliant transceivers are used. In particular, users are warned to use only agency approved products that comply with the local laser safety regulations for Class 1 laser products.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this product. No installation, adjustment, maintenance or repairs should be performed by either the operator or the user.

Handling Energized Products

General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective earth terminal. If an earth lug is provided on the product, it should be connected to the protective earth at all times, by a wire with a diameter of 18 AWG or wider. Rack-mounted equipment should be mounted only in earthed racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

Connection of AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

In cases when the power distribution system is IT type, the switch must disconnect both poles simultaneously.

Connection of DC Mains

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC mains systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC supply is electrically isolated from any AC source and that the installation complies with the local codes.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Before connecting the DC supply wires, ensure that power is removed from the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated in the building installation.

If the DC mains are floating, the switch must disconnect both poles simultaneously.

Connection of Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

Ports	**Safety Status**	
V.11, V.28, V.35, V.36, RS-530, X.21, 10 BaseT, 100 BaseT, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M	SELV	Safety Extra Low Voltage: Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC.
xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1	TNV-1	Telecommunication Network Voltage-1: Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible.
FXS (Foreign Exchange Subscriber)	TNV-2	Telecommunication Network Voltage-2: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines.
FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN	TNV-3	Telecommunication Network Voltage-3: Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible.

Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Extra caution should be exercised during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The earthing and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk, there are restrictions on the diameter of wires in the telecom cables, between the equipment and the mating connectors.

Caution To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

Attention Pour réduire les risques s'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good earth connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lock-washers and torque. If an external grounding lug is provided, connect it to the earth bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables. In such cases, special instructions are provided in the manual.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electro-static discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching earth ground or wear an ESD preventive wrist strap.

FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Warning per EN 55022 (CISPR-22)

Warning	This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures.
Avertissement	Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.
Achtung	Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkströrungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Declaration of Conformity

Manufacturer's Name: RAD Data Communications Ltd.

Manufacturer's Address: 24 Raoul Wallenberg St.
Tel Aviv 69719
Israel

Declares that the product:

Product Name: **SPS-6, SPS-12**

Conforms to the following standard(s) or other normative document(s):

EMC:	EN 55022 (1994)	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
	EN 50082-1 (1992)	Electromagnetic compatibility – Generic immunity standards for residential, commercial and light industry.
Safety:	EN 60950 (1992/93)	Safety of information technology equipment, including electrical business equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, 18 September 1996

Haim Karshen
VP Quality

European Contact: RAD Data Communications GmbH, Otto-Hahn-Str. 28-30,
85521 Ottobrunn-Riemerling, Germany

Contents

Chapter 1. Introduction

1.1 Overview 1-1
1.2 Technical Specifications 1-2

Chapter 2. Installation and Setup

2.1 Introduction 2-1
2.2 Unpacking 2-1
2.3 Site Requirements 2-1
Power 2-1
Data Channel Connections 2-1
Main Links Connections 2-2
Front and Rear Panel Clearance 2-2
Ambient Requirements 2-2
2.4 Hardware Configuration Information 2-2
General Information 2-2
Internal Jumpers 2-3
INIT-NOR jumper, JP39 2-3
IR-ETH jumper, J13 2-4
IR-ETH jumper, JP44 2-4
Interface Board 2-4
Jumper Setting Procedure 2-5
2.5 Installation in 19" Racks 2-6
Installing the Unit 2-6
2.6 Cable Connections 2-7
General 2-7
Asynchronous Data Channel Connections 2-7
Synchronous Links Connection 2-8
Power Connection 2-8

Chapter 3. Operation

3.1 General 3-1
3.2 Controls, Indicators and Connectors 3-1
Front Panel Controls, Indicators and Connectors 3-1
Rear Panel Controls and Connectors 3-3
3.3 Operating Instructions 3-3
General 3-3
Power-On 3-3
Normal Operation 3-4
Power-off 3-4
3.4 Upgrading the Software 3-4
3.5 What to do in Case of Malfunction 3-6
Preliminary Checks 3-6
Troubleshooting 3-6

Appendix A. Connector Pinouts

Chapter 1
Introduction

1.1 Overview

The SPS-6, SPS-12 Multiprotocol FRAD/Switches provide easy, cost-effective access to a packet switching network. They also provide packet switching capability for both X.25 and Frame Relay.

SPS-6, SPS-12 has six or twelve ports, respectively, which support aggregate data rates up to 2 Mbps (for each three ports). Each port can be configured to any of the following protocols: X.25, Frame Relay, HDLC, STM, Async, SDLC or SLIP. Switching between ports is provided for X.25, Frame Relay, SDLC and encapsulated protocols.

Two asynchronous channels are available with each module. The asynchronous channels can only be configured as X.28.

The synchronous ports can be V.24, V.35, X.21 and RS-530. Links 1 and 2 (and 7 and 8 for SPS12) can be ISDN-S, IR-ETH, U-INT, DDS or CSU/DSU. Interfaces for all ports can be DCE or DTE layer 1 (user-configurable). In the SPS-6, ports 1 and 2 can operate as one DDS, Ethernet or ISDN (2B channels) port. The same applies for ports 7 and 8 in the SPS-12.

SPS-6, SPS-12 support a wide range of applications. For more information on the SPS-6, SPS-12 applications and features, refer to the RAD Packet Switching Applications Guide.

1.2 Technical Specifications

Synchronous Links	*Number of Links*	6 for SPS-6
		12 for SPS-12
	Data Rate	Each 3 links aggregate up to 2.15 Mbps
	Interface	RS-232/V.24, X.21, V.35, V.36/RS-449, or RS-530 (selected during ordering)
		Link 1 and 2 (7 and 8) can also be: IR-ETH, ISDN-S, U-INT, DDS or CSU/DSU.
	Connectors	RS-232/V.24: 25-pin D-type, female
		X.21: 25-pin D-type, female, via adapter cable
		V.35: 25-pin D-type, female, via adapter cable
		RS-530: 25-pin D-type, female
		V.36/RS-449: 37-pin D-type, female, via adapter cable
		IR-ETH: 10BaseT, UTP cable, RJ-45
		ISDN: S-interface, UTP cable, RJ-45
		DDS: CSU/DSU interface, UTP cable, RJ-45
	Configuration Clocking	External or internal clocking for receive and transmit paths
Asynchronous Channels	*Number of Channels*	2
	Data Rate	75 bps to 38.4 kbps, programmable
	Interface	RS-232/V.24 (DCE)
	Connector	RJ-45
	Flow Control	X-ON/X-OFF
	Channel Log-on Messages	Herald and bulletin (user-definable)
	Command Modes	ITU-T Rec. X.28 and proprietary extensions
		ITU-T Rec.X.29
	Terminal Handling	Enhanced, handling beyond ITU-T Rec. X.3 requirements
Packet Size		Up to 4096 bytes for X.25
		Up to 8 K for other protocols
RAM Size		2048K

LED Indicators		Power
		Link activity (for each link)
		Sub-channels activity
		Loss of synchronization (for each link)
		Error
		Overflow
		Test
Power	*Supply*	Supply voltage: 115 or 230 VAC (in accordance with order), 50/60 Hz
	Consumption	Consumption: 20W
Physical	*Height*	4.4 cm (1.7 in)
	Width	43.2 cm (17.0 in)
	Depth	29.8 cm (11.7 in)
	SPS-6 Weight	1.8 kg (3.9 lb)
	SPS-12 Weight	2.2 kg (4.8 lb)
Environment	*Temperature*	0–50°C (32–122°F)
	Humidity	Up to 90%, non-condensing

Chapter 2
Installation and Setup

2.1 Introduction

This chapter provides mechanical and electrical installation procedures for SPS-6, SPS-12, and basic operating procedures.

SPS-6, SPS-12 is delivered completely assembled. It is designed for installation as a desktop unit or mounted in a 19" rack.

After installing the unit, refer to the RAD Packet Switching Guide for system configuration information and procedures.

In case a problem is encountered, refer to the RAD Packet Switching Guide for test and diagnostics instructions.

2.2 Unpacking

A preliminary inspection of the equipment container should be made before unpacking. Evidence of damage should be noted and reported immediately.

➤ **To unpack the equipment:**

1. Place the container on a clean flat surface, cut all straps, and open or remove top.
2. Take out the unit carefully and place it securely on a clean surface.
3. Inspect the product for damage. Report any damage found immediately.

2.3 Site Requirements

Power

The SPS-6, SPS-12 unit should be installed within 1.5m (5 ft) of an easily accessible grounded AC outlet capable of supplying 115 or 230VAC, in accordance with the nominal supply voltage of your unit.

Data Channel Connections

SPS-6, SPS-12 has two RJ-45 connectors, one for each asynchronous data channel.

Main Links Connections

The SPS-6 has six main links connectors and the SPS-12 has twelve main links connectors. The main links connector depends on the ordered interface:

- RS-232/V24: 25-pin D-type, female connector
- X.21: 25-pin D-type, female connector
- V.35: 25-pin D-type, female connector
- RS-530: 25-pin D-type, female connector
- V.36/RS-449: 37-pin D-type, female connector (via adapter cable)
- IR-ETH: 10BaseT, UTP cable, RJ-45
- ISDN: S-interface, UTP cable, RJ-45
- DDS: CSU/DSU interface, UTP cable, RJ-45.

Front and Rear Panel Clearance

If you install the SPS-6/SPS-12 in a 19" rack, allow at least 90 cm (36 inches) of frontal clearance for operator access. Allow at least 10 cm (4 inches) clearance at the rear of the unit for interface cable connections.

Ambient Requirements

The ambient operating temperature of the SPS-6/SPS-12 should be 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

2.4 Hardware Configuration Information

General Information

The SPS-6/SPS-12 contains two different types of printed circuit boards. *Figure 2-1* shows an internal view of the SPS-12 with the different boards.

The main board. This board contains most of the unit circuits and jumpers.

Twelve main link interface boards for SPS-12 or six boards for SPS-6, which determine the interface type. The appropriate board is factory-installed in accordance with your order, and is not field-replaceable. For further details, see the RAD Packet Switching Guide.

Note *The default settings of the unit jumpers are suitable for most applications. Check the default positions explained below. If the requirements for your application are different, set the internal jumpers in accordance with the requirements, before the installation.*

All other configuration actions are performed using the SPS-6/SPS-12 command facility, after the installation is completed. Information and detailed instructions for these operations appear in the RAD Packet Switching Guide.

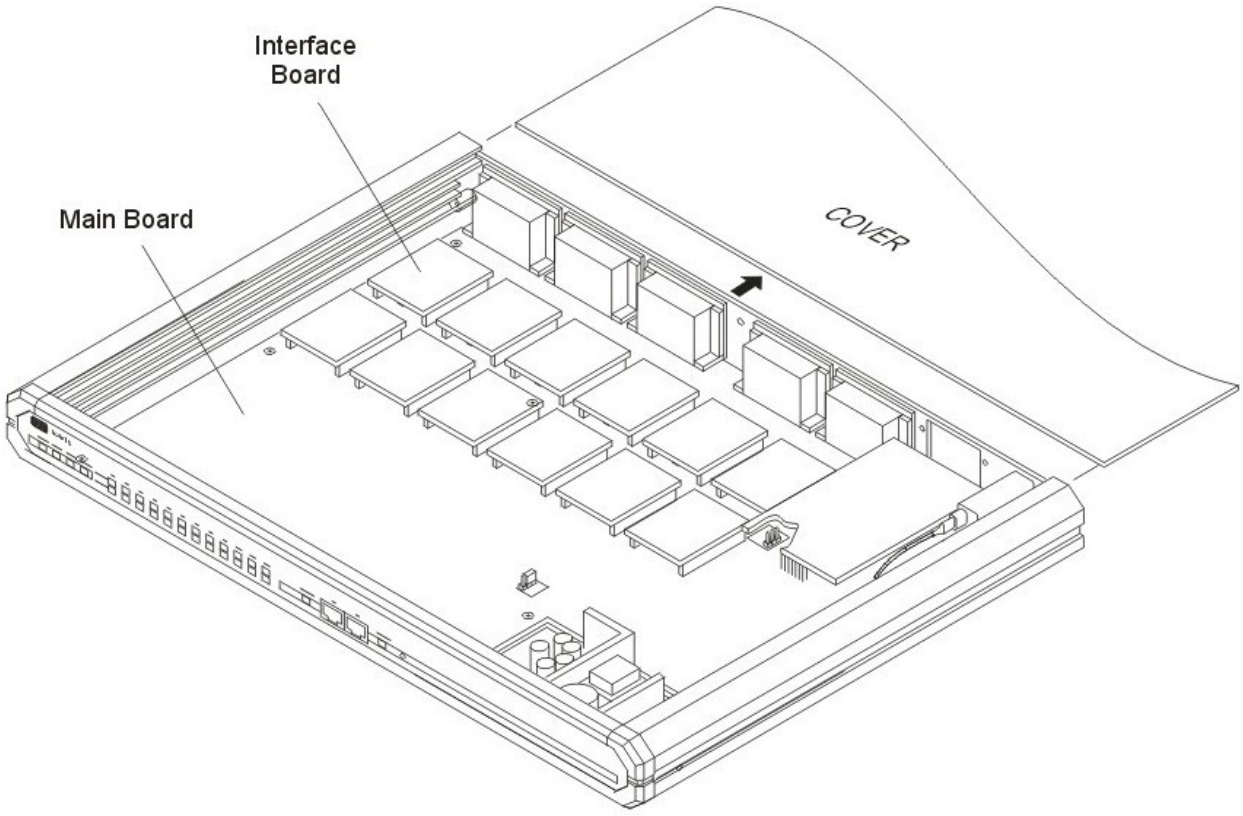


Figure 2-1. SPS-12 Internal Boards

Internal Jumpers

Warning

Access inside the equipment is only permitted to qualified and authorized service personnel. To avoid the danger of electrical shock, always disconnect the power cable from mains before opening the unit.

The SPS-6, SPS-12 main board has three internal jumpers, labeled J13, JP44 and JP39. Refer to *Figure 2-2* (*Figure 2-2* shows the SPS-12, but the internal jumpers location for the SPS-6 is similar).

INIT-NOR jumper, JP39

This jumper is used to select the default set of configuration parameters stored in SPS-6, SPS-12. The jumper has two possible positions:

NOR

Normal operation. SPS-6, SPS-12 uses the parameters selected by the user during the last configuration session.

INIT

Initialization. At startup, the unit loads the default configuration (factory-set and common to all SPS-6, SPS-12 units). To select the default configuration, refer to the RAD Packet Switching Guide. The factory setting is **NOR**.

IR-ETH jumper, J13

When set to NOR, this jumper enables the IR-ETH interface at links 7.

IR-ETH jumper, JP44

When set to NOR, this jumper enables the IRETH interface at links 1.

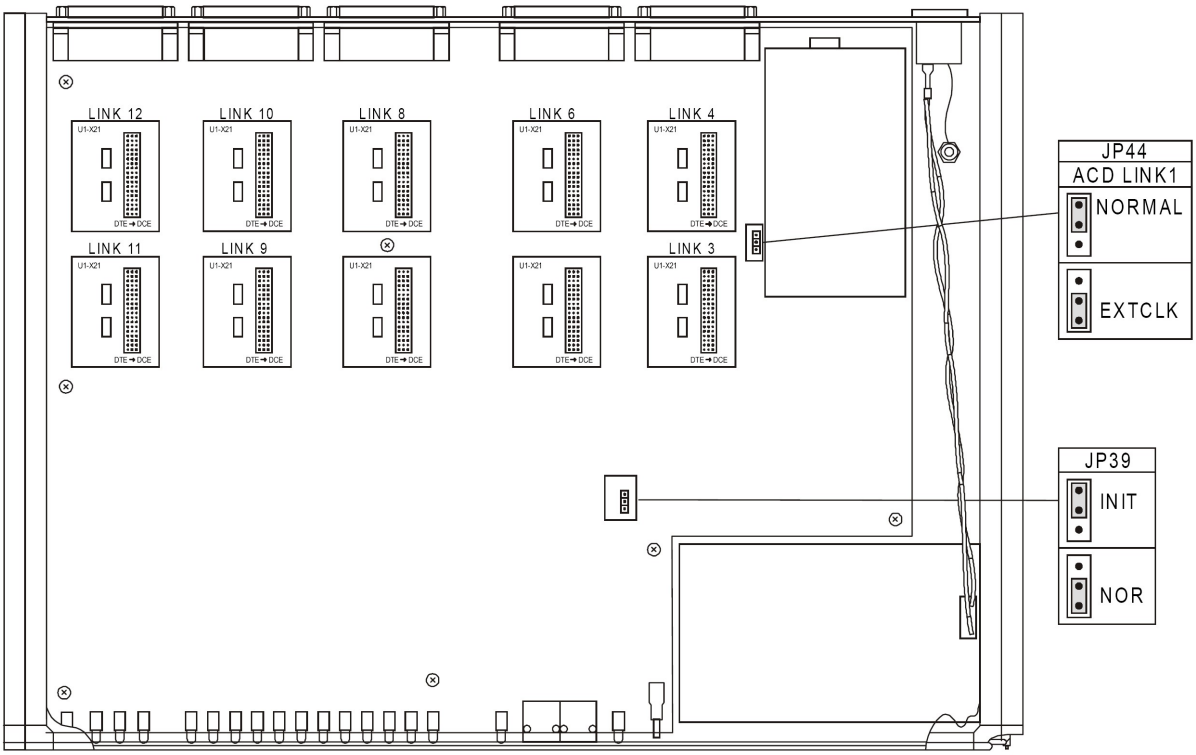


Figure 2-2. SPS-12, Identification of Internal Jumpers

Interface Board

The SPS-6/SPS-12 is available with eight types of removable interface boards.

The interface board types are:

- V.24 (RS-232)
- V.35
- V.36 (RS-530)
- X.21
- ISDN
- IR-ETH
- DDS.

Warning

To avoid the danger of electrical shock, always disconnect the power cable from wall plug before opening the SPS-6/SPS-12.

The V.24/V.35/RS-530/X.21 interface board can be configured as DCE or DTE by changing the main jumper. The main jumper consists of multiple jumpers that must be changed together. Each board is marked DCE □ DTE, and the default setup is in accordance with the client's order. The V.24 interface board is shown in *Figure 2-3*.

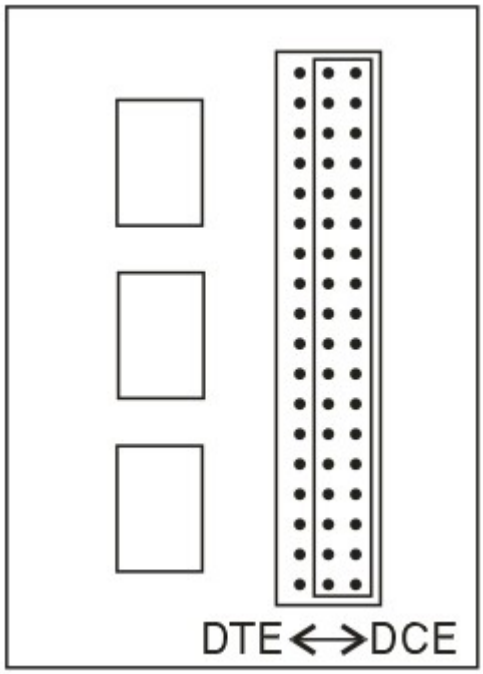


Figure 2-3. SPS-M/V.24 Interface Board

The interface board determines the physical layer configuration of a link.

If the board is set as DCE, a flat cable must connect the link to a terminal. The link uses the SPS-6/SPS-12 internal clock and the clock parameter must be configured as internal clock (see the RAD Packet Switching Guide).

If the board is set as DTE, the link receives its clock from an external source and the clock parameter must be configured as external clock (see the RAD Packet Switching Guide).

Jumper Setting Procedure

Warning

In order to avoid the possibility of electrical shock, always disconnect the power cable from wall plug before opening the SPS-6/SPS-12.

1. Access the printed circuit board of the SPS-6/SPS-12 by opening the screw fastening the top cover to the case, and remove top cover.
2. Refer to *Figure 2-2* or *Figure 2-3* and identify jumper locations and settings. Change settings as required.
3. Replace the SPS-6/SPS-12 cover, and fasten its screw. Do not exert excessive torque while tightening these screws.

2.5 Installation in 19" Racks

SPS-6, SPS-12 can be installed in a 19" rack. Unit height corresponds to 1U (1.75"). The width of the unit is slightly less than the available mounting width.

An adapter kit provides the hardware necessary for installation of the SPS-6/SPS-12 in a 19" rack. The paragraph below provides step-by-step instructions for this procedure.

Warning

Disconnect the units from AC power while performing the following procedures.

Installing the Unit

The rack adapter kit for the installation includes two short brackets. The brackets are fastened by means of screws to the two side walls of the case. The installation of the SPS-6 is shown in *Figure 2-4*; the installation of the SPS-12 is similar.

➤ **To install the unit:**

1. Attach the two brackets to the side walls of the unit. Each bracket is fastened by two screws (with flat washers), which are inserted into the two front holes on the side wall (nuts are already in place, on the inner side of the wall).

   After attaching the brackets, the unit is ready for installation in the 19" rack.

2. Fasten the brackets to the side rails of the 19" rack using four screws (not included in the kit), two on each side.

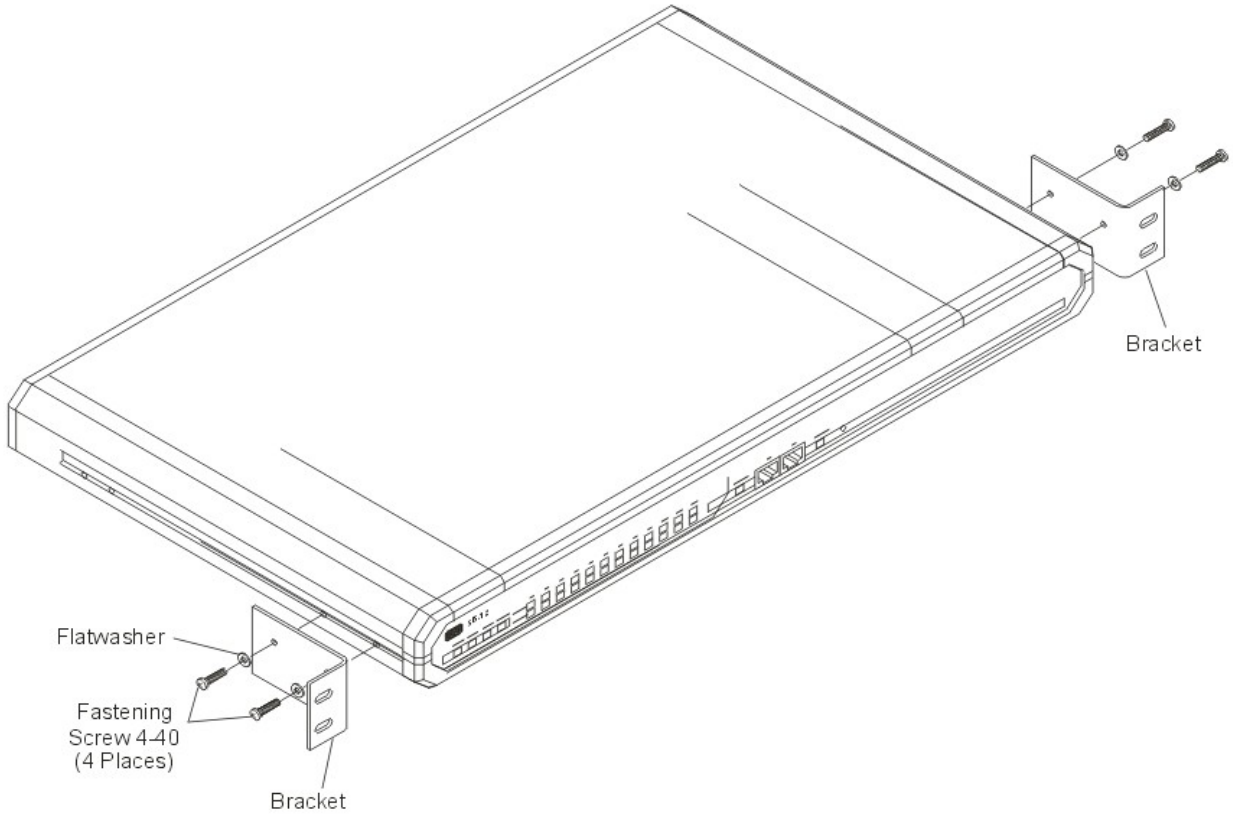


Figure 2-4. Installation of SPS-12 in 19" Rack

2.6 Cable Connections

General

SPS-6 has **six** connectors and SPS-12 has **twelve** connectors located on the rear panel that serve as the synchronous links.

Two RJ-45 connectors are located on the front panel for the asynchronous data channels.

Asynchronous Data Channel Connections

The SPS-6, SPS-12 channel interfaces are configured as data communication equipment (DCE) interfaces, thereby allowing direct connection, via RS-232 port cables, to data terminal equipment (DTE). If modems are used to extend the range (tail-end circuits), cross-over cables are required. Channel interfaces are asynchronous; therefore clock signals are neither supported, nor required.

Synchronous Links Connection

The SPS-6, SPS-12 synchronous links interfaces are configured as DTE interfaces, intended for connection to synchronous modems that are capable of providing the clock signals that determine the unit's synchronous links data rate. The synchronous link connector type depends on the interface type:

- RS-232/V.24: 25-pin D-type, female connector
- X.21: 25-pin D-type, female connector
- V.35: 25-pin D-type, female connector
- RS-530: 25-pin D-type, female connector
- V.36/RS-449: 37-pin D-type, female connector (via adapter cable)
- IR-ETH: 10BaseT, UTP cable, RJ-45
- ISDN: S-interface, UTP cable, RJ-45
- DDS: CSU/DSU interface, UTP cable, RJ-45.

For the connector pinouts, refer to *Appendix A*.

Note *The user data cables and the synchronous links cables should be shielded, in order to comply with FCC rules. SPS-6, SPS-12 and its data interfaces will work well even if the cables are not shielded, but some radio interference may occur.*

Power Connection

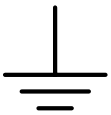
AC power should be supplied to SPS-6, SPS-12 through the 5 ft (1.5m) power cable terminated by a standard 3-prong plug. Connect the cable between the AC mains connector on the unit's rear panel and a standard grounded AC outlet.

Warning

BEFORE APPLYING POWER TO THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective ground conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current, as marked on the SPS-6/SPS-12 rear panel, are used for replacement.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.



Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

Chapter 3
Operation

3.1 General

SPS-6, SPS-12 supports a wide range of applications, such as:

- Backbone for a low-cost private synchronous network with optional connection to the public network
- Expansion of the number of asynchronous channels, using RAD STM statistical multiplexers (proprietary)
- Public Network access via redundant links
- Running asynchronous data in X.25 packets over Frame Relay
- Running asynchronous data directly over Frame Relay (e.g., SLIP protocol over Frame Relay)
- Routing between several Frame Relay devices or networks (Frame Relay to Frame Relay switching)
- Connection of devices supporting HDLC protocol to the X.25 or Frame Relay network.

For more detailed configuration information, refer to the *RAD Packet Switching Guide* and *RAD Packet Switching Applications Guide*.

3.2 Controls, Indicators and Connectors

Front Panel Controls, Indicators and Connectors

Table 3-1 lists the functions of the SPS-12 front panel indicators and connectors. The numbers under the heading "Item" refer to the identification numbers in *Figure 3-1*. The SPS-6 front panel is similar to the SPS-12 but has 6 main links activity and sync indicators.

Figure 3-1. SPS-12 Front Panel Controls, Indicators and Connectors

Table 3-1. Controls, Indicators and Connectors

Item	Control, Indicator or Connector	Function
1	PWR Indicator	Lights when the unit is powered.
2	Main Links Activity Indicators	Indicators, one for each main link, light when the corresponding link is active (receives or transmits frames).
3	Channel Activity Indicators	Indicators, one for each channel, light when the corresponding channel is active (receives or transmits data).
4	SYNC Indicators	Indicators, one for each main link, indicate the unit's synchronization status. Condition — Indication Off — SPS-6/SPS-12 is not powered On and — SPS-6/SPS-12 is powered synchronized with the corresponding synchronous DTE or DCE peer. Flashing (Continuous) — SPS-6/SPS-12 is powered but not synchronized with the corresponding peer.
5	ERR Indicator	Lights when a hardware malfunction is detected during the self-test automatically performed at power-up, or after pressing the RESET push-button.
6	OVF Indicator	Lights when the SPS-6, SPS-12 buffers are full. In a properly designed system, this condition usually indicates that one of the units connected to the SPS-6/SPS-12 does not respond to the flow control commands sent by the SPS-6, SPS-12, a condition that could be caused by incorrect configuration of the SPS-6/SPS-12.
7	TEST Indicator	Lights to indicate that the unit is in the diagnostics mode (one of the test loops active) or that one of its channels is connected to the SPS-6, SPS-12 command facility. In either case, traffic is interrupted.
8	Channel Connectors	Connection to the SPS-6, SPS-12 channels (one connector per channel).

Rear Panel Controls and Connectors

Table 3-2 lists the functions of the SPS-12 rear panel controls and connectors. The numbers under the heading "Item" refer to the identification numbers in *Figure 3-2*. The SPS-6 rear panel is similar to the SPS-12 but has 6 links connectors.

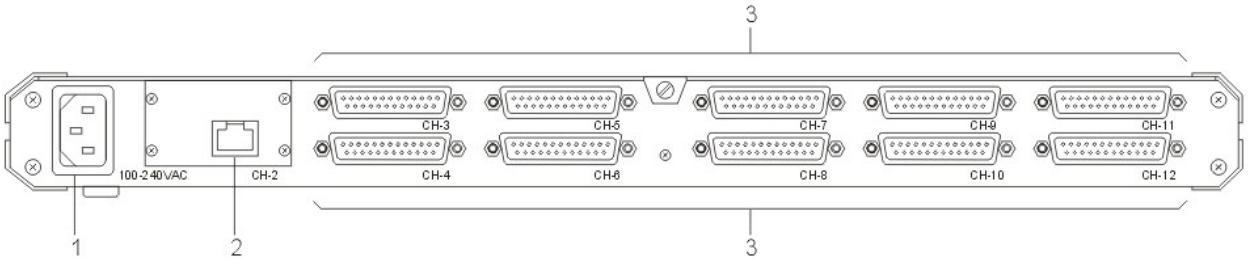


Figure 3-2. SPS-12 Rear Panel Controls and Connectors

Table 3-2. SPS-6/SPS-12 Rear Panel Controls and Connectors

Item	Control Connector	Function
1	Power Connection	AC power connector with integral fuse
2	Asynchronous Channel Connectors	Connects to the asynchronous channel
3	Synchronous Links Connectors	Connection to X.25 link

3.3 Operating Instructions

General

After preparing the unit for operation (see *Chapter 2*), it normally operates unattended. Operator intervention is only required when the SPS-6/SPS-12 is set up for the first time or must be adapted to new operational requirements.

Note *The unit's configuration is stored in a non-volatile memory, and is not affected when power is turned off.*

Power-On

Connect the power cable to the rear power connector; the PWR indicator should light.

If none of the links to the synchronous DTE/DCE peers are operational, the SYNC indicators of the unit flash. Wait until one of the links becomes operational, and then check that the corresponding SYNC indicator stops flashing and lights continuously.

While the unit performs a self-test, check that the ERR, OVF and TEST indicators turn off after a short interval.

Normal Operation

During normal operation, the PWR, SYNC and MAIN indicators light continuously and the TEST, OVF and ERR indicators remain off.

Channel activity indicators flash according to the traffic load, and turn off when the channel is idle.

Note that when the TEST indicator lights, traffic is interrupted, even if all the other indications are normal.

Power-off

To turn the SPS-6/SPS-12 off, disconnect its power cable from mains.

3.4 Upgrading the Software

SPS-6, SPS-12 supports a flash memory that enables updating the software via a terminal. It is not necessary to replace the EPROMs to upgrade the software. Once connected to the terminal, follow on-screen instructions to perform the upgrade.

➤ **To upgrade the software:**

1. Connect the terminal to port no.1 on the device.
2. In the Main menu, select Option 2, System Control.

```
                    SYSTEM CONTROL MENU
                    -------------------
1.)     Link down
2.)     Link up
3.)     Clear channel
4.)     Clear LCN
5.)     Update date
6.)     Update time
7.)     Reset statistics
8.)     Rearrange NOVRAM
9.)     Reset
10.)    Set default configuration
11.)    Disconnect dial link
12.)    Enable software upgrade

<Enter> EXIT
```

3. In the System Control menu, select option 12. The following screen appears:

```
THIS ACTION WILL ENABLE YOU TO DOWNLOAD A NEW SOFTWARE VERSION
AFTER RESET

In order to do so, please connect a terminal configured:
9600, N, 8, 1 to link no. 1 and follow the instructions on the
screen.

ARE YOU SURE? (YES/NO)
```

4. Type **YES** and press <**Enter**>.
5. Reset the device by pressing the **Reset** button on the front panel of the module. If a problem occurs during the software download, the following screen appears:

```
Software MAY not be valid!

Please select one of the following:

1.)     9600 bits/s
2.)     19200 bits/s
3.)     38400 bits/s
4.)     115200 bits/s
5.)     Run the existing software (NO download)
```

6. Select option 5 to run the existing software. The following message appears:

```
Please change terminal setting to:
115200, N, 8, 1, LINK1
Start the software download.
```

When the software is downloaded successfully, the following message appears:

```
CONGRATULATIONS
Software loaded successfully.
```

3.5 What to do in Case of Malfunction

Preliminary Checks

In case a problem occurs, the following actions will help you return the SPS-6/SPS-12 to normal operation.

- Check if the SPS-6/SPS-12 is powered (PWR indicator should light).
- Check if cables are properly connected.
- Check if the equipment connected to the SPS-6/SPS-12 is powered and operates normally.
- Check SPS-6/SPS-12 indications.
- Check if configuration of the SPS-6/SPS-12 PAD and that of the remote packet switching device correspond to the requirements of the equipment connected to its channels.

Troubleshooting

If the preliminary checks do not correct the problem, press RESET or turn the unit off and then on again. If the problem repeats, refer to the RAD Packet Switching Guide for additional operations.

Appendix A

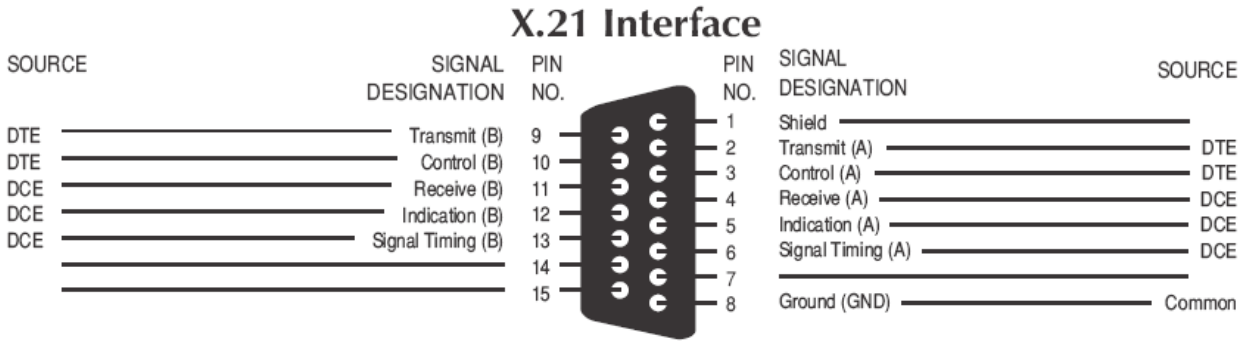
Connector Pinouts

This appendix provides information needed for the SPS-6, SPS-12 interface connections.

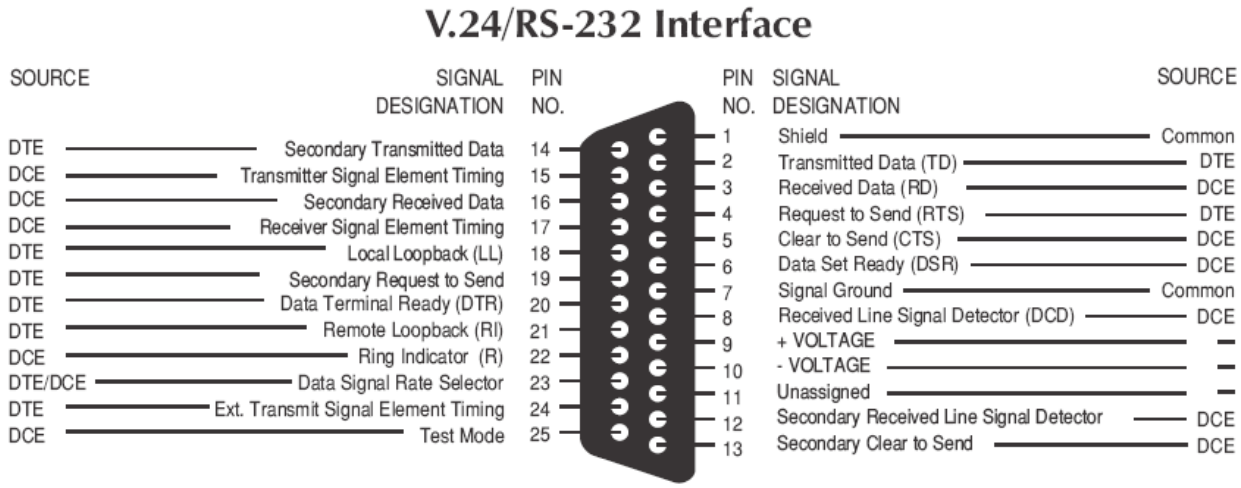
The information presented in this appendix includes a description of the Control connector, connector pin functions and where applicable – the recommended wiring for relevant adapter cables.

A.1 Interface Connectors

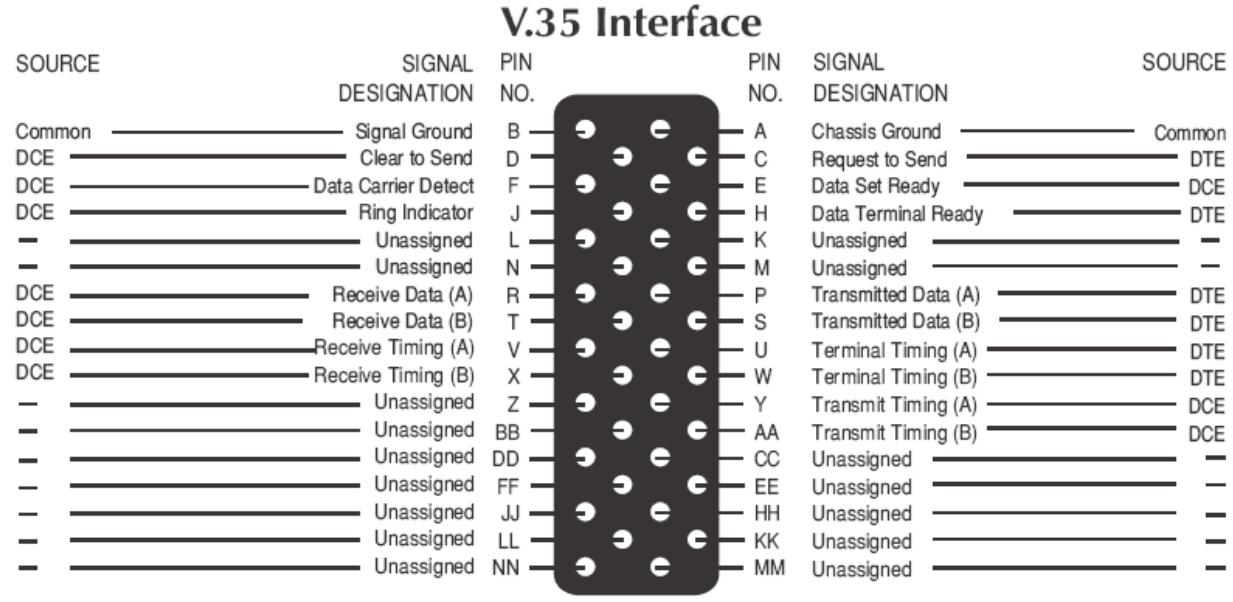
X.21 Port Pinouts



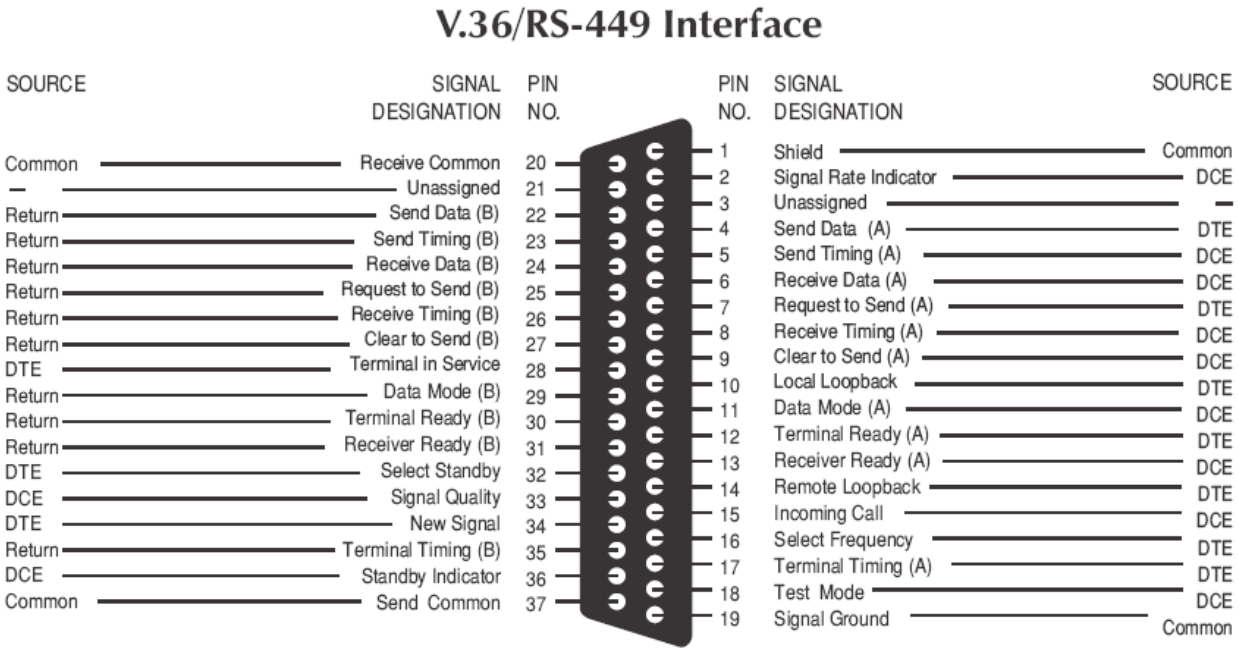
V.24 Port Pinouts



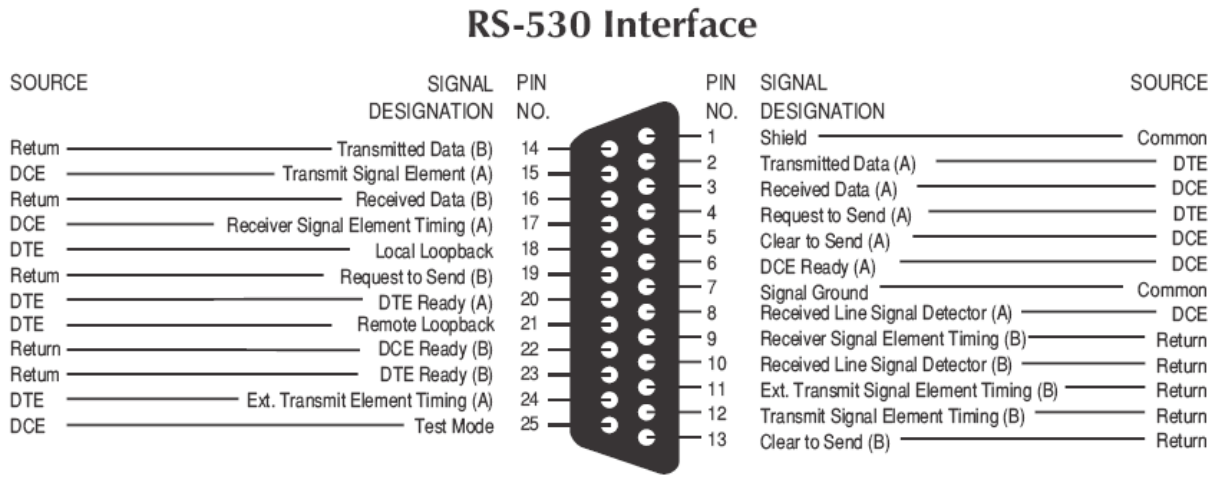
V.35 Port Pinouts


V.35 Interface
SOURCE
SIGNAL DESIGNATION
PIN NO.
PIN NO.
SIGNAL DESIGNATION
SOURCE
Common Signal Ground B A Chassis Ground Common
DCE Clear to Send D C Request to Send DTE
DCE Data Carrier Detect F E Data Set Ready DCE
DCE Ring Indicator J H Data Terminal Ready DTE
– Unassigned L K Unassigned –
– Unassigned N M Unassigned –
DCE Receive Data (A) R P Transmitted Data (A) DTE
DCE Receive Data (B) T S Transmitted Data (B) DTE
DCE Receive Timing (A) V U Terminal Timing (A) DTE
DCE Receive Timing (B) X W Terminal Timing (B) DTE
– Unassigned Z Y Transmit Timing (A) DCE
– Unassigned BB AA Transmit Timing (B) DCE
– Unassigned DD CC Unassigned –
– Unassigned FF EE Unassigned –
– Unassigned JJ HH Unassigned –
– Unassigned LL KK Unassigned –
– Unassigned NN MM Unassigned –

V.36 Port Pinouts


V.36/RS-449 Interface
SOURCE
SIGNAL DESIGNATION
PIN NO.
PIN NO.
SIGNAL DESIGNATION
SOURCE
Common Receive Common 20 1 Shield Common
– Unassigned 21 2 Signal Rate Indicator DCE
Return Send Data (B) 22 3 Unassigned –
Return Send Timing (B) 23 4 Send Data (A) DTE
Return Receive Data (B) 24 5 Send Timing (A) DCE
Return Request to Send (B) 25 6 Receive Data (A) DCE
Return Receive Timing (B) 26 7 Request to Send (A) DTE
Return Clear to Send (B) 27 8 Receive Timing (A) DCE
DTE Terminal in Service 28 9 Clear to Send (A) DCE
Return Data Mode (B) 29 10 Local Loopback DTE
Return Terminal Ready (B) 30 11 Data Mode (A) DCE
Return Receiver Ready (B) 31 12 Terminal Ready (A) DTE
DTE Select Standby 32 13 Receiver Ready (A) DCE
DCE Signal Quality 33 14 Remote Loopback DTE
DTE New Signal 34 15 Incoming Call DCE
Return Terminal Timing (B) 35 16 Select Frequency DTE
DCE Standby Indicator 36 17 Terminal Timing (A) DTE
Common Send Common 37 18 Test Mode DCE
19 Signal Ground Common

RS-530 Port Pinouts



A.2 Control Connector

The control connector of SPS-6, SPS-12 is an RJ-45 8-pin female connector with a serial RS-232 DCE interface, intended for connection to an ASCII-based terminal. Connector pin functions are listed in *Table A-1*.

- To connect a supervision terminal having a 9-pin connector to the control connector, use the appropriate adapter cable (CBL-RJ45/D9/F/STR or CBL-RJ45/D9/M/STR, supplied). *Figure A-1* shows the wiring diagram of this cable.

Table A-1. RJ-45 Control Connector Pin Functions

Pin	Function
1	GND
2	Not connected
3	Receive Data (RXD) from terminal
4	Not connected
5	Transmit Data (TXD) to terminal
6	Not connected
7	GND
8	Not connected

Terminal Control Table

The terminal control port cable has an 8-pin RJ-45 connector on one side, and a 9-pin, D-type, female connector on the other side.

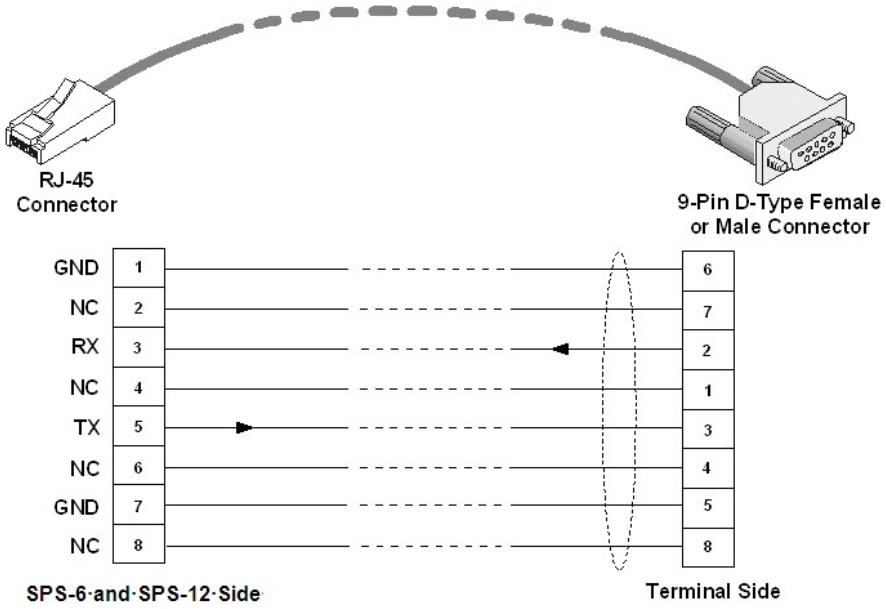


Figure A-1. Wiring RJ-45 to DB-9 Adapter Cable (CBL-RJ45/DB9/F/STR)

RAD data communications

24 Raoul Wallenberg St., Tel Aviv 69719, Israel
Tel: +972-3-6458181, Fax: +972-3-6483331, +972-3-6498250
E-mail: erika_y@rad.com, Web site: www.rad.com

Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

Manual Name: SPS-6, SPS-12

Publication Number: 216-201-10/06

Please grade the manual according to the following factors:

	Excellent	*Good*	*Fair*	*Poor*	*Very Poor*
Installation instructions	❒	❒	❒	❒	❒
Operating instructions	❒	❒	❒	❒	❒
Manual organization	❒	❒	❒	❒	❒
Illustrations	❒	❒	❒	❒	❒
The manual as a whole	❒	❒	❒	❒	❒

What did you like about the manual?

_____

_____

_____

_____

_____

Error Report

Type of Error(s) or Problem(s):

- ❒ Incompatibility with product
- ❒ Difficulty in understanding text
- ❒ Regulatory information (Safety, Compliance, Warnings, etc.)
- ❒ Difficulty in finding needed information
- ❒ Missing information
- ❒ Illogical flow of information
- ❒ Style (spelling, grammar, references, etc.)
- ❒ Appearance
- ❒ Other _____

Please list the exact page numbers with the error(s), detail the errors you found (information missing, unclear or inadequately explained, etc.) and attach the page to your fax, if necessary.

_____

_____

_____

_____

Please add any comments or suggestions you may have.

_____

_____

_____

You are:

- ❒ Distributor
- ❒ End user
- ❒ VAR
- ❒ Other _____

Who is your distributor? _____

Your name and company: _____

Job title: _____

Address: _____

Direct telephone number and extension: _____

Fax number: _____

E-mail: _____

data communications

www.rad.com

INTERNATIONAL HEADQUARTERS:

24 Raoul Wallenberg Street, Tel Aviv 69719, Israel, Tel: 972-3-6458181
Fax: 972-3-6498250, 972-3-6474436, Email: market@rad.com

NORTH AMERICA HEADQUARTERS:

900 Corporate Drive, Mahwah, N.J. 07430, Tel: (201) 529-1100
Toll Free: 1-800-444-7234, Fax: (201) 529-5777, Email: market@radusa.com

Publication No. 216-201-10/06